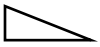
ECE 5256 Project 3

Correlation and Convolution in the Spatial Domain

1 Correlation and convolution

Consider two images. One should be relatively large, like 512 x 512 pixels that contains several sparsely populated points with magnitude 255, and the other is small such as 15 x 15 that contains a non-symmetric object like,  with the object white and the background black.

Perform both the correlation, and convolution of the two images separately and correctly label each result. Make the resulting image the same size as the larger input image.

2 Matched filtering

Create or download an image of several lines of text. Don't make the text too small, and make the text lighter than the background. Extract one character from the text image and create a small image from it. Perform the correlation between the two images with the result the same size as the larger image. Note the position(s) of the maxima.

(a) Do they identify the characters in the text?
(b) Determine the ratio of the correlation peak corresponding to a letter and the next highest (or highest peak).
(c) Normalize the correlation result by dividing it by an image created from the convolution of image of the text and a kernel the same size as your one character image, but the kernel contains all 1's.
(d) What is the new ratio of the correlation peak corresponding to a letter and the next highest peak.

3 Frequency response of spatial filtering

(a) Compare the frequency response in 1-D of the cross-section of two different spatial filters of size 1 x 3: all 1's [1 1 1], an approximation to the Laplacian [-1 2 -1]. Identify the differences.

To do this, create a vector of all 0's of length 512 for example. Place the spatial filter in the first position of the vector, and plot the absolute value of the 1-D Fourier Transform (fft command).

Turn in:

1 Project title, course number, date due
2 Brief description of what you have done
3 Explanation and/or discussion of results
4 Appendix: program listing